

NASA TECH BRIEF

Ames Research Center



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Projections of Scan Patterns on Human Retina

The problem:

To modify a fundus camera for the tracking of eye movements.

The solution:

Use the optics of a fundus camera and, with the aid of an inverted system, provide a flying-spot circular-scanning light source in the normal film plane (to be projected on the retina) and a broadband photo-detector in the position normally occupied by the light source.

How it's done:

In principle, a fundus camera could be used in its normal photographic mode with a steady light source of the proper spectral content in place of the flash tube, a light stop placed so that it is in focus on the retina and limits illumination to a small annular region of the retina, and a vidicon camera tube in the film plane to scan, in a circular path, the image of the annular region of the illuminated retina. However, such a system presents some difficulties, largely because the annular zone of illumination must be considerably larger than the circular scanning spot to provide some room for alignment and drift; so much energy must be directed into the eye that the pupil tends to close and there can be a loss of contrast in the retinal image because the intense illumination is reflected and scattered within the eye.

The improved system, best identified as an inverted system, utilizes a flying light spot in the plane of the film, and a sensitive photocell or photomultiplier at the position usually occupied by the steady light source or flash lamp. The normal high-resolution output system thus becomes a high-resolution input system that focuses an image of the flying spot onto the fundus by way of light passing through the central

zone of the pupil. Light reflected from the fundus passes out through the annular zone of the pupil and is collected by the photocell; the temporal signal is a measure of the reflectivity of the fundus along the scanning focus. Hence, no more light than necessary is put into the eye for the measurement, and internal scattering after the fundus reflection now affects only the net gain of the system and not the picture contrast.

The cathode ray tube used in the inverted scanning to provide the flying spot is a very high-resolution tube with an experimental blue phosphor emitting light of a wavelength band found to be best for viewing the human eye; i.e., 400–500 nm at a bandwidth of less than 100 nm. Because the tube has a very short persistence (nominally 0.6 microsec), about 1000 picture elements per millisecond frame can be obtained.

Notes:

1. Preliminary experiments indicate that signals can be received with this configuration, but that considerable adjustments are required for optimum performance.
2. The following documentation may be obtained from:
National Technical Information Service
Springfield, Virginia 22151
Single document price \$6.00
(or microfiche \$0.95)
Reference: NASA CR-1121 (N68-35109),
Research Study of a Fundus Tracker for
Experiments in Stabilized Vision.
3. No additional documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: B72-10193

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

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